

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-17 are currently pending. Claims 1 and 13 have been amended by the present amendment. The changes to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 1-17 were rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement; Claims 1-3, 5, 7, 8, 10, and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Patent Application No. 11-172796 to Honma (hereinafter “the ‘796 patent”) in view of U.S. Patent No. 6,044,667 to Chenoweth (hereinafter “the ‘667 patent”) and U.S. Patent No. 4,531,218 to Williamson (hereinafter “the ‘218 patent”); Claims 13 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Application No. 01/006238 to Watanabe et al. (hereinafter “the ‘238 patent”) or the ‘796 patent, in view of the ‘667 and ‘218 patents; Claims 4, 6, 9, and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘796, ‘667, and ‘218 patents, further in view of U.S. Patent No. 6,886,364 to Ohama et al. (hereinafter “the ‘364 patent”); Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘238 or ‘769 patents in view of the ‘667 and ‘218 patents, further in view of the ‘364 patent; Claim 16 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘796, ‘667 and ‘218 patents, further in view of U.S. Patent No. 5,364,426 to Richards (hereinafter “the ‘426 patent”); and Claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘796, ‘667, and ‘218 patents, further in view of U.S. Patent No. 3,997,316 to Koontz (hereinafter “the ‘316 patent”) and U.S. Patent No. 3,806,621 to Machlan (hereinafter “the ‘621 patent”).

Applicants respectfully submit that the rejection of the claims under 35 U.S.C. § 112, first paragraph, is rendered moot by the present amendment to Claim 1. Claim 1 has been amended to no longer recite “controlling” electric current. Accordingly, Applicants respectfully submit that the claims satisfy the written description requirement.

Amended Claim 1 is directed to a process of reforming a quartz glass crucible, wherein the quartz glass crucible is reformed by an arc discharge generated by electrodes positioned around a rotational axis and configured to heat an inside surface of the crucible while the crucible is rotated, the process comprising: (1) arranging the electrodes in an electrode structure in which neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration; (2) determining a phase of an electric current based on a number and an arrangement of the electrodes; (3) forming a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration, by applying electric current of the determined phase to the electrodes; (4) heating the inside surface of the crucible while the crucible is rotated; and (5) removing one of a foreign substance located on the inside surface and a bubble located under the inside surface. Claim 1 has been amended to include the step of determining a phase of an electric current based on a number and an arrangement of the electrodes, and to clarify that the heating of the inside surface of the crucible in the process of reforming a quartz glass crucible is performed while the crucible is rotated. The changes to Claim 1 are supported by the originally filed specification and do not add new matter.¹

Regarding the rejection of Claim 1 under 35 U.S.C. § 103, the Office Action asserts that the ‘796 patent discloses everything in Claim 1 with the exception of the “specifics of the

¹ See, e.g., page 6, line 7 through page 7, line 30.

arc discharging electrodes" and "controlling electric current to the electrodes,"² and relies on the '667 and '218 patents to remedy those deficiencies.

The '796 patent is directed to a quartz glass crucible for pulling up a silicon single crystal by feeding a powdery quartz raw material into a rotating mold, forming a formed body having a crucible shape, arc melting the formed body to obtain a quartz glass crucible, further mechanically grinding the whole inner surface of the quartz glass crucible, and remelting the inner surface by arc melting or high frequency plasma flame melting.³ However, Applicants respectfully submit that the '796 patent fails to disclose any description of the structure of the electrodes or the type of power source, i.e., A/C or D/C, or the number of A/C phase when using A/C power. In particular, Applicants respectfully submit that the '769 patent fails to disclose arranging electrodes in an electrode structure in which neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration, and determining a phase of an electric current based on a number and an arrangement of the electrodes such that, by applying the electric current of the determined phase to the electrodes, a stable ring-like arc is formed between the neighboring electrodes, as recited in Claim 1. Further, Applicants respectfully submit that the '796 patent fails to disclose heating an inside surface of the crucible while the crucible is rotated so as to reform the quartz glass crucible, as recited in Claim 1. The '796 patent discloses that the crucible is rotated at the time of making the crucible, but not rotated at the time of remelting an inner surface thereof.

The '667 patent is directed to a system for melting and delivering glass to a work area such as spinners for making fiberglass including a melter, and a melter for melting glass from batch material to form a pool of molten glass including a bottom wall, inside wall, and at least one discharge port. As shown in Figure 1A, the '667 patent discloses six electrodes equally spaced in a circular pattern around the center of a cylindrical tank. Further, the '667

² See pages 3 and 4 of the outstanding Office Action.

³ '796 patent, Abstract.

patent discloses that the plurality of electrodes are arranged within the molten pool so as to generate a “hot spot” of molten glass.

However, Applicants respectfully submit that the ‘667 patent fails to disclose the step of determining a phase of an electric current based on a number and an arrangement of the electrodes; and forming a stable ring-like arc between the neighboring electrodes, without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration, by applying electric current of the determined phase to the electrodes, as recited in Claim 1. *The ‘667 patent is silent regarding what kind of phase should be used with the six electrodes so as to form a stable ring-like arc without generating the continuous arc between electrodes facing each other*, as recited in Claim 1. Moreover, the ‘667 patent fails to disclose heating an inside surface of the crucible while the crucible is rotated, as recited in amended Claim 1. Further, Applicants respectfully submit that the ‘667 application has a different objective to that of the invention recited in Claim 1 in that the objective of the ‘667 patent is to generate a “hot spot” to be located away from the sidewall of the furnace in order to prevent wear on the wall.

The ‘218 patent is directed to a glass melting furnace that includes electrodes arranged in rows of four electrodes across the width of the furnace. For example, as shown in Figure 1, twenty-four electrodes are arranged in groups of four in a row. The ‘218 patent discloses that a 300 V A/C source is applied to the multiple rows of electrodes via a current limiting controller, but does not include any description of the A/C phase or the combination of A/C phase and the number of electrodes, as recited in Claim 1. In particular, Applicants respectfully submit that the ‘218 patent fails to disclose the step of determining a phase of an electric current based on a number and an arrangement of the electrodes, and forming a stable ring-like arc between the neighboring electrodes without generating the continuous arc between electrodes facing each other by applying electric current of the determined phase to

the electrodes, as recited in amended Claim 1. Further, Applicants respectfully submit that the '218 patent fails to disclose the step of heating the inside surface of the crucible while the crucible is rotated, as recited in amended Claim 1.

Thus, no matter how the teachings of the '796, '667, and '218 patents are combined, the combination does not teach or suggest the step of determining a phase of an electric current based on a number and an arrangement of electrodes, and forming a stable ring-like arc between neighboring electrodes without generating a continuous arc between electrodes facing each other by applying electric current of the determined phase to the electrodes, as recited in amended Claim 1. Moreover, no matter how the teachings of the '796, '667, and '218 are combined, the combination does not teach or suggest heating the inside surface of the crucible while the crucible is rotated in a process of reforming a quartz glass crucible, as recited in amended Claim 1. Accordingly, Applicants respectfully submit that the rejection of Claim 1 (and all similarly rejected dependent claims) is rendered moot by the present amendment to Claim 1.

In the outstanding Office Action, the stated motivation for combining the teachings of the '796, '667, and '218 patents is "in order to control a high temperature arc discharge to a large diameter crucible for even heating" and "in order to balance the temperature of the molten glass."⁴ However, Applicants respectfully submit that the Office Action is simply stating perceived advantages of Applicants' invention as motivation to combine the outstanding references, without showing that, without Applicants' specification, one of ordinary skill in the art would have even thought to address the problem. Such hindsight reconstruction of Applicants' invention cannot be used to establish a *prima facie* case of obviousness.

⁴ See page 4 of the outstanding Office Action.

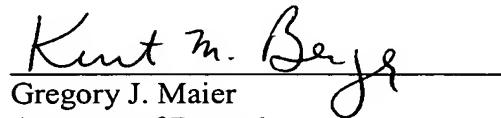
Regarding the rejections of dependent Claims 4, 6, 9, 11, 16, and 17, Applicants respectfully submit that the '316, '621, and '364 patents fail to remedy the deficiencies of the '796, '667, and '218 patents, as discussed above. Accordingly, Applicants respectfully submit that the rejections of dependent Claims 4, 6, 9, 11, 16, and 17 are rendered moot by the present amendment to Claim 1.

Claim 13 recites limitations analogous to the limitations recited in Claim 1. Moreover, Claim 1 has been amended in a manner analogous to the amendment to Claim 1. Accordingly, for reasons analogous to the reasons stated above for the patentability of Claim 1, Applicants respectfully submit that the rejections of Claim 13 (and dependent Claim 15) is rendered moot by the present amendment to Claim 13. In particular, Applicants respectfully submit that the '238 patent does not disclose the step of determining a phase of an electric current based on a number and an arrangement of the electrodes, and forming a ring-like arc between the neighboring electrodes without generating a continuous arc between electrodes facing each other by applying electric current of the determined phase to the electrodes, as recited in amended Claim 13.

Thus, it is respectfully submitted that independent Claims 1 and 13 (and all associated dependent claims) patentably define over any proper combination of the '796, '667, '238, '364, '218, '426, '621, and '316 patents.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,



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